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ABSTRACT

A study of the effects of a resource room enrichment program was field tested on academically gifted fourth, fifth, and sixth grade students in 65 elementary schools. The Ss were pre- and posttested on the Cognitive Abilities Test. A norm referenced research design was used to control for normal development. Findings indicated that participation in the program resulted in the accelerated development of cognitive skills involving the manipulation of verbal, numerical, and spatial symbols. Quantitative scores showed the greatest increase and there was a comparatively large increase in the nonverbal scores of the fourth grade students. (Author/PHR)

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THE EFFECT OF PARTICIPATION IN A RESOURCE ROOM ENRICHMENT PROGRAM ON THE COGNITION SKILLS OF FOURTH THROUGH SIXTH GRADERS OF HIGH ACADEMIC STANDING OR POTENTIAL[1]

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Fourth-, fifth-, and sixth-grade students who participated in a resource room enrichment program for academically gifted students in 65 elementary schools in the Dallas Independent School District were pre- and posttested on the Cognitive Abilities Test (CAT). A norm-referenced research design was implemented wherein the posttest means for the batteries of the CAT were compared to corresponding expected posttest means derived as equipercentiles of the pretest means. Statistical tests of significance indicated the program produced accelerated development of cognitive skills involving the manipulation of verbal, numerical, and spatial symbols.

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Selection procedures and methods of evaluation of educational programs for the gifted and talented appear to be major problem areas (Breiter, 1978). Placement of students into programs for the academically gifted, for example, is frequently done using intelligence test scores. Because school systems do not always administer intelligence tests to entire student populations, and because there is growing sentiment to reduce or eliminate intelligence testing, the broad screening of student populations for admission to a gifted program is frequently not possible. On the other hand, although programs often purport to improve problem-solving skills, logical reasoning, independent

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study skills, and such related constructs, evaluation is often conducted using achievement variables.[2] Clearly, the typical paradigm for the selection of students for, and the evaluation of, educational programs for the academically gifted is sometimes technically flawed by logistical problems as well as measurement problems.

The Dallas Independent School District has developed and operated an enrichment program for academically gifted students which seeks to overcome some of the logistical and measurement problems alluded to above. During 1978-79 the Dallas Talented and Gifted (TAG) program was implemented in 65 elementary schools in an expanded field test of the program. The program had operated in 27 of the 65 schools during 1977-78 in a more narrow field test (Holden & Lym, 1978). Before that, the program had been pilot tested under state funding in a single elementary school.

The 1978-79 Dallas TAG program was an enrichment program for fourth- through sixth-grade students of above average achievement. Teachers in the program were specially screened and trained by the program director. Established in each school was a resource room for instructing the TAG students. Approximately 20% of the instructional time available during a week was devoted to the TAG program. The curriculum for the program, which was developed by the program director and the TAG teachers, was designed to improve logical reasoning skills, independent study skills, problem-solving skills, and research skills.

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[2]For example, Milbury (1974), in the investigation of the evaluation methods used in 21 programs for gifted and talented students in the state of Connecticut, reported that product evaluation generally focused on student achievement gains.

Screening of students for the TAG program was conducted during January and February of 1978. Both objective (i.e., test performance) and subjective (i.e., teachers' judgments) achievement criteria entered into the screening. Within each school a seven-member committee was formed. The principal, the TAG teacher, one teacher each for grades three through six, and another member appointed by the principal made up the committee. Its purpose was to evaluate all students for placement in the program and to recommend to the program director those who should be placed in the program. Fall test scores for 1976-77 on the Iowa Tests of Basic Skills (ITBS), Form 5 (Hieronymus & Lindquist, 1971)[3] and scores on the District's TAG Referral Form were considered in the placement process.[4] As a guide, committees were told that a student should score at or above the 80th percentile (national large city norm) on the Reading Test or Mathematics Problem-Solving Test of the ITBS and should receive a score of at least 54 (of a possible 80) on the Referral Form. The committee, however, retained the authority to recommend students, and by the affirmative vote of at least five members could recommend any student for placement, regardless of scores. The program director reviewed the action of the school committees and sent approval forms to parents for final placement in the program.

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[3]The District-wide achievement testing of Dallas students in 1976-77 was conducted in the fall of 1976. Thereafter, beginning in the spring of 1978, the District has maintained a spring-to-spring testing program. Therefore, the fall 1976 data were the most recent at the time of screening.

[4]The Referral Form asks for a 4-point rating (with 4 as the desirable score) on 18 characteristics (e.g., the student can work with a minimum of adult supervision). Two final questions, scored either 0 or 4, ask the rater to make a judgment as to whether or not the student is gifted and creative, respectively, and to explain why.

Method

Variables. Data for the study came from the Cognitive Abilities Test (CAT), Form 3 (Thorndike & Hagen, 1979), which was administered in the Fall 1978 as a pretest and in the Spring 1979 as a posttest. The CAT consists of 10 subtests organized into 3 batteries. Those batteries are the Verbal, Quantitative, and Nonverbal. Respectively, the batteries measure the ability of students to perform a variety of cognitive tasks, via the subtests, using verbal, numerical, and spatial symbols. The constructs assessed by the CAT are as follows:

Battery	Subtest	Construct
Verbal (100 items)	1	Knowledge of word synonyms
	2	Comprehension of idea expressed in a sentence
	3	Recognition of similarities among verbal stimuli
	4	Verbal analogies
Quantitative (60 items)	1	Quantitative relations -- greater than, equal to, less than
	2	Number series
	3	Equation building
Nonverbal (80 items)	1	Figure series
	2	Figure analogies
	3	Figure synthesis

Analyses were performed using Universal Scale Scores (USSs), or the normalized standard scores for the batteries, as dependent variables. Percentiles for grade level were used to determine the level of performance of students in the program compared to the national norm groups at the same level.

Sample. The TAG program functioned in grades four through six at 65 elementary schools in the Dallas Independent School District. Reports

submitted by resource teachers showed that 3,453 students participated in the program. Of that number, 2,696 (78%) received both the pre- and posttest administrations of the CAT. Absence at the time the CAT was administered, failure to be enrolled at the time of testing, and lack of permission from the parent(s) or legal guardian(s) to administer the test were the reasons for the reduction in the number of data points. The latter reason, lack of permission to test, occurred because of the District's policy that written permission must be given by parents or guardians before the District can administer a cognitive skills test. Approximately 2% of the students counted in the enrollment total were not tested because permission to test was not granted or permission forms were not recovered. Very few students were admitted to the program after the end of the first 6-weeks term, which was the time when the pretest was administered. However, approximately 10% of the students who were counted as enrolled terminated the program before the time the posttest was adminstered. The majority of those who left the program did so because their families moved, although about one-fifth of those who left (approximately 2% of the total TAG population) returned to regular classes at the request of parents or school personnel. Absence at the time of testing, either for the pretest, posttest, or both, accounted for the remainder of the reduction in the number of data points, approximately 10%.

Among the students who were pre- and posttested, the ethnic breakdown was as follows: 68% White, 18% Black, 12% Hispanic, and 2% other. The percentage of female students was 56, and the percentage of male students was 44. The distributions for ethnic group and sex for each grade level were very similar to those of the total group.

Procedure. To guard against the appraisal of a program significantly modified from its prescribed form (Charters & Jones, 1973), observations of TAG classrooms and interviews of TAG teachers and resource teachers were undertaken from November 1978 through January 1979. To assess the impact of the program on students' cognitive skills, a norm- referenced research design was used. At the end of the first term (October 1978), when enrollment in the program had stabilized, levels C, D, and E, of the CAT were administered to grades four, five, and six, respectively. These were the levels of the test that were designated by the publisher to be administered to students who were "rapid" in cognitive development. The same tests were administered to students in May 1979. Because achievement scores from the ITBS, rather than cognitive skills scores, were used to place students into the program, the pre- to posttest gains on the CAT were not adversely influenced by regression artifacts (Lord, 1963).

An increase over time in raw score or USS is expected on the CAT as the student matures. The norm-referenced design effectively controls for development in cognitive ability by determining whether or not the gain from pre- to posttest is more than that experienced by the norm group. Two critical assumptions accompany the use of the design: (1) the educational intervention for the norm group defines the traditional educational program and (2) developmental growth is accurately represented by the increase in scale score which corresponds to the maintenance of the same percentile rank from pre- to posttest. These assumptions for the norm-referenced design were accepted in the analyses of the CAT data, and one-sample t tests were performed to determine the

statistical significance of the differences between mean posttest USSs and the equipercentile posttest USSs corresponding to the mean pretest USSs. Separate tests were conducted for each test battery and grade level.

Results

The observations of TAG classrooms and interviews with the TAG teachers revealed that the program was implemented as intended by administrative personnel. Therefore, justification existed for analyzing the CAT data and attributing the changes in scores to the effect of the program within the limits of internal validity for the norm-referenced design.

Verbal, quantitative, and nonverbal CAT scores for the students who participated in the program, and for whom both pre- and posttest scores were available, are shown by grade level in Table 1. Means and standard deviations of the USSs are presented, as well as the grade percentiles corresponding to the mean USSs. Also presented are equipercentile USSs, or posttest USSs corresponding to the pretest grade percentiles, Finally, *t* statistics are presented for the statistical tests of significance of the differences between the posttest mean USSs and the equipercentile USSs. In all cases, for the three test batteries at each of the three grade levels, the statistical tests of significance revealed that the mean posttest USS was greater than the equipercentile USS.

As shown in Table 1, pretest percentiles were highest at each grade on the verbal battery of the CAT. Pretest percentiles were lowest for the fourth and fifth grade on the nonverbal battery, and for the sixth grade on the quantitative battery. Posttest percentiles were highest for

Table 1

Performance of TAG Students on the Cognitive Abilities Test

Test Battery	Number[a]	Pretest Mean USS[b]	Pretest USS S.D.	Pretest Grade %ile	Posttest Mean USS[b]	Posttest USS S.D.	Posttest Grade %ile	Equipercentile USS[c]	t
Grade Four									
Verbal	1035	118	14.41	71	129	15.37	78	125	8.37**
Quantitative	1035	116	17.94	67	130	18.75	80	122	13.73**
Nonverbal	1035	120	20.84	62	133	21.66	78	124	13.37**
Grade Five									
Verbal	874	130	15.87	74	138	16.66	78	135	5.32**
Quantitative	873	130	15.36	73	140	19.14	81	135	7.72**
Nonverbal	874	131	20.13	71	138	18.98	75	136	3.12**
Grade Six									
Verbal	787	136	17.28	69	145	17.16	77	141	6.54**
Quantitative	787	134	19.04	66	146	20.08	77	139	9.78**
Nonverbal	787	136	22.51	68	142	21.96	71	140	2.55*

Note. Student's t calculated on the difference between the posttest mean USS and the equipercentile USS.

[a]Number of students with both pre- and posttest scores.

[b]USS: Universal Scale Score.

[c]The posttest USS corresponding to the pretest grade percentile.

*p < .05

**p < .01

fourth and fifth grades on the quantitative battery; posttest percentiles for sixth grade were highest for the verbal and quantitative batteries. Compared to pretest percentiles, posttest percentiles were relatively homogeneous, remaining for the most part in the upper 70s.

Across grades and test batteries all percentile ranks increased from pre- to posttest. Substantial gains in percentile rank were noted at grade four on the quantitative and nonverbal batteries, and at grade six on the quantitative battery. Moderate gains occurred on the verbal battery for grades four and six and on the quantitative battery for grade five. Small gains were found for the nonverbal battery at grades five and six, and for the verbal battery at grade five.

Discussion

The Dallas program, in contrast to many programs for the talented and gifted, did not seek to serve only intellectually precocious students. The often accepted definition of gifted as two or more standard deviations above average (Stanley, 1979) was not remotely considered. The screening procedure allowed students who were somewhat above average, as well as those who were substantially above average, to be admitted to the program.

Because the program sought to improve reasoning and problem-solving skills, a cognitive abilities test was used as the evaluation criterion. Findings indicated that participation in the program resulted in the accelerated development of cognitive skills involving the manipulation of verbal, numerical, and spatial symbols. Changes in percentile rank from pre- to posttest were all positive, ranging from 3 to 16 across test batteries and grades. Overall, quantitative scores showed the greatest

increase. Notably, a comparatively large increase in nonverbal scores was found for fourth-grade students, while the increases at grades five and six were small and just beyond the critical values for statistical significance at the .01 and .05 levels, respectively. The focus of the curriculum was the apparent cause of the difference in gains between the quantitative battery and the other two batteries. This conclusion is substantiated by findings of the earlier evaluation of the program (Holden & Lym, 1978) during its pilot test in 27 schools wherein increases in logical and numerical reasoning, as measured by the California Short-Form Test of Mental Maturity (SF-CTMM), (Sullivan, Clark, & Tiegs, 1963) were greater than expected while the increase in verbal concepts scores on the SF-CTMM was not.

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